

WHAT IS CLAIMED IS:

1. A lithium ion secondary battery, comprising:  
a positive electrode comprising an active material  
containing a composite oxide;

5 a negative electrode; and

a nonaqueous electrolyte;

the composite oxide having a composition  
represented by a structural formula (1) given below:



10 where Me1 is at least one kind of an element  
selected from the group consisting of B, Mg, Al, Sc,  
Ti, V, Cr, Mn, Co, Cu, Zn, Ga, Y, Zr, Nb, Mo, Tc, Ru,  
Sn, La, Hf, Ta, W, Re, Pb and Bi, X is at least  
one kind of a halogen element selected from the  
15 group consisting of F, Cl, Br and I, the molar ratios  
x, y, z are  $0.02 \leq x \leq 1.3$ ,  $0.005 \leq y \leq 0.5$ , and  
 $0.01 \leq z \leq 0.5$ , A contains at least one element  
selected from the group consisting of Na, K and S, and  
each of the Na content, the K content and the S content  
20 of the composite oxide falls within a range of between  
600 ppm and 3,000 ppm.

2. A lithium ion secondary battery according to  
claim 1, wherein said element A further includes Ca,  
and the Ca content in said composite oxide is not  
25 higher than 500 ppm.

3. A lithium ion secondary battery according to  
claim 2, wherein said element A includes a combination

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of Ca, Na and S, a combination of Na and Ca or  
a combination of S and Ca.

4. A lithium ion secondary battery according to  
claim 1, wherein each of the Na content, the K content  
5 and the S content in said composite oxide falls within  
a range of between 1,000 ppm and 2,500 ppm.

5. A lithium ion secondary battery according to  
claim 1, wherein said element A includes Na and S.

6. A lithium ion secondary battery according to  
10 claim 1, wherein at least a part of said element A is  
precipitated in triple points present in grain  
boundaries of said composite oxide.

7. A lithium ion secondary battery, comprising:  
a positive electrode comprising an active material  
15 containing a composite oxide;

a negative electrode; and

a nonaqueous electrolyte;

the composite oxide having a composition  
represented by a structural formula (2) given below:

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$$\text{Li}_x(\text{Ni}_{1-y}\text{Me}_y)(\text{O}_{2-z}\text{X}_z) + \text{A} + b\text{B} \quad \dots (2)$$

where Me is at least one kind of an element  
selected from the group consisting of B, Mg, Al, Sc,  
Ti, V, Cr, Mn, Co, Cu, Zn, Ga, Y, Zr, Nb, Mo, Tc, Ru,  
Sn, La, Hf, Ta, W, Re, Pb and Bi, X is at least  
25 one kind of a halogen element selected from the  
group consisting of F, Cl, Br and I, the molar ratios  
x, y, z are  $0.02 \leq x \leq 1.3$ ,  $0.005 \leq y \leq 0.5$ , and

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0.01  $\leq z \leq$  0.5, A contains at least one element selected from the group consisting of Na, K and S, and each of the Na content, the K content and the S content of the composite oxide falls within a range of between 600 ppm and 3,000 ppm, B contains at least one element selected from the group consisting of Si and Fe, and the content b of said element B in said composite oxide falls within a range of between 20 ppm and 500 ppm.

8. A lithium ion secondary battery according to claim 7, wherein said element A further includes Ca, and the Ca content in said composite oxide is not higher than 500 ppm.

9. A lithium ion secondary battery according to claim 7, wherein the content b of said element B in said composite oxide falls within a range of between 20 ppm and 250 ppm.

10. A lithium ion secondary battery according to claim 7, wherein at least a part of said element A and at least a part of said element B are precipitated in triple points present in grain boundaries of said composite oxide.

11. A lithium ion secondary battery, comprising:

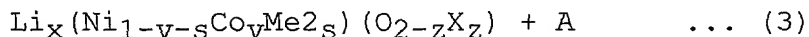
a positive electrode comprising an active material containing a composite oxide;

a negative electrode; and

a nonaqueous electrolyte;

the composite oxide having a composition

represented by a structural formula (3) given below:



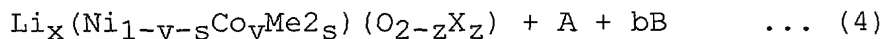
where Me2 is at least one kind of an element selected from the group consisting of B, Mg, Al, Sc, Ti, V, Cr, Mn, Cu, Zn, Ga, Y, Zr, Nb, Mo, Tc, Ru, Sn, La, Hf, Ta, W, Re, Pb and Bi, X is at least one kind of a halogen element selected from the group consisting of F, Cl, Br and I, the molar ratios x, v, s and z are  $0.02 \leq x \leq 1.3$ ,  $0.005 \leq v \leq 0.5$ ,  $0.005 \leq s \leq 0.5$  and  $0.01 \leq z \leq 0.5$ , A contains at least one element selected from the group consisting of Na, K and S, and each of the Na content, the K content and the S content of the composite oxide falls within a range of between 600 ppm and 3,000 ppm.

12. A lithium ion secondary battery according to claim 11, wherein said element A further includes Ca, and the Ca content in said composite oxide falls within a range of between 20 ppm and 500 ppm.

13. A lithium ion secondary battery according to claim 11, wherein said element Me2 is at least one kind of an element selected from the group consisting of Ti, V, Cr, Zr, Nb, Mo, Hf, Ta and W.

14. A lithium ion secondary battery, comprising:  
a positive electrode comprising an active material containing a composite oxide;  
a negative electrode; and  
a nonaqueous electrolyte;

the composite oxide having a composition represented by a structural formula (4) given below:



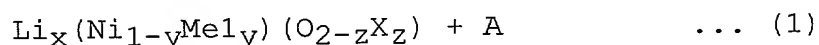
where Me2 is at least one kind of an element

5 selected from the group consisting of B, Mg, Al, Sc, Ti, V, Cr, Mn, Cu, Zn, Ga, Y, Zr, Nb, Mo, Tc, Ru, Sn, La, Hf, Ta, W, Re, Pb and Bi, X is at least one kind of a halogen element selected from the group consisting of F, Cl, Br and I, the molar ratios x, v, s and z are  $0.02 \leq x \leq 1.3$ ,  $0.005 \leq v \leq 0.5$ ,  $0.005 \leq s \leq 0.5$  and  $0.01 \leq z \leq 0.5$ , A contains at least one element selected from the group consisting of Na, K and S, each of the Na content, the K content and the S content of the composite oxide falls within a range of between 600 ppm and 3,000 ppm, B contains at least one element selected from the group consisting of Si and Fe, and the content b of said element B in said composite oxide falls within a range of between 20 ppm and 500 ppm.

20 15. A lithium ion secondary battery according to claim 14, wherein said element A further includes Ca, and the Ca content in said composite oxide is not higher than 500 ppm.

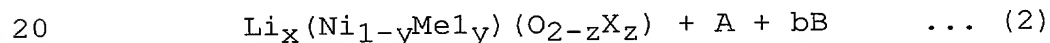
25 16. A lithium ion secondary battery according to claim 14, wherein said element Me2 is at least one kind of an element selected from the group consisting of Ti, V, Cr, Zr, Nb, Mo, Hf, Ta and W.

17. A positive electrode active material containing a composite oxide having a composition represented by a structural formula (1) given below:



5        where Me1 is at least one kind of an element selected from the group consisting of B, Mg, Al, Sc, Ti, V, Cr, Mn, Co, Cu, Zn, Ga, Y, Zr, Nb, Mo, Tc, Ru, Sn, La, Hf, Ta, W, Re, Pb and Bi, X is at least one kind of a halogen element selected from the group  
10        consisting of F, Cl, Br and I, the molar ratios x, y, z are  $0.02 \leq x \leq 1.3$ ,  $0.005 \leq y \leq 0.5$ , and  $0.01 \leq z \leq 0.5$ , A contains at least one element selected from the group consisting of Na, K and S, and each of the Na content, the K content and the S content  
15        of the composite oxide falls within a range of between 600 ppm and 3,000 ppm.

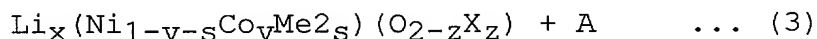
18. A positive electrode active material containing a composite oxide having a composition represented by a structural formula (2) given below:



      where Me1 is at least one kind of an element selected from the group consisting of B, Mg, Al, Sc, Ti, V, Cr, Mn, Co, Cu, Zn, Ga, Y, Zr, Nb, Mo, Tc, Ru, Sn, La, Hf, Ta, W, Re, Pb and Bi, X is at least  
25        one kind of a halogen element selected from the group consisting of F, Cl, Br and I, the molar ratios x, y, z are  $0.02 \leq x \leq 1.3$ ,  $0.005 \leq y \leq 0.5$ , and

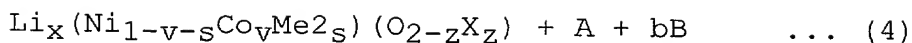
0.01  $\leq$  z  $\leq$  0.5, A contains at least one element selected from the group consisting of Na, K and S, and each of the Na content, the K content and the S content of the composite oxide falls within a range of between 600 ppm and 3,000 ppm, B contains at least one element selected from the group consisting of Si and Fe, and the content b of said element B in said composite oxide falls within a range of between 20 ppm and 500 ppm.

19. A positive electrode active material containing a composite oxide having a composition represented by a structural formula (3) given below:



where Me2 is at least one kind of an element selected from the group consisting of B, Mg, Al, Sc, Ti, V, Cr, Mn, Cu, Zn, Ga, Y, Zr, Nb, Mo, Tc, Ru, Sn, La, Hf, Ta, W, Re, Pb and Bi, X is at least one kind of a halogen element selected from the group consisting of F, Cl, Br and I, the molar ratios x, v, s and z are 0.02  $\leq$  x  $\leq$  1.3, 0.005  $\leq$  v  $\leq$  0.5, 0.005  $\leq$  s  $\leq$  0.5 and 0.01  $\leq$  z  $\leq$  0.5, A contains at least one element selected from the group consisting of Na, K and S, and each of the Na content, the K content and the S content of the composite oxide falls within a range of between 600 ppm and 3,000 ppm.

20. A positive electrode active material containing a composite oxide having a composition represented by a structural formula (4) given below:



where Me2 is at least one kind of an element selected from the group consisting of B, Mg, Al, Sc, Ti, V, Cr, Mn, Cu, Zn, Ga, Y, Zr, Nb, Mo, Tc, Ru, Sn, La, Hf, Ta, W, Re, Pb and Bi, X is at least one kind of a halogen element selected from the group consisting of F, Cl, Br and I, the molar ratios x, v, s and z are  $0.02 \leq x \leq 1.3$ ,  $0.005 \leq v \leq 0.5$ ,  $0.005 \leq s \leq 0.5$  and  $0.01 \leq z \leq 0.5$ , A contains at least one element selected from the group consisting of Na, K and S, each of the Na content, the K content and the S content of the composite oxide falls within a range of between 600 ppm and 3,000 ppm, B contains at least one element selected from the group consisting of Si and Fe, and the content b of said element B in said composite oxide falls within a range of between 20 ppm and 500 ppm.